

Chapter 10 - Miscellaneous Construction

2-1001 Riprap

Riprap consists of angular stones used to protect foundations of piers, abutments, walls, slopes of embankments, and waterways from damage. Riprap is covered in Article 7.03 of the *Standard Specifications*.

The area to be protected by riprap is shaped. If bedding material is called for in the plans, the bedding material is placed and compacted to the plan line and grade. Riprap is placed to its full-course thickness in one operation. Placement should not displace the underlying material. The finished surface should be free of small stones and clusters of large stones. Rearranging the stones may be required to produce a reasonably well-graded distribution of the specified stone sizes.

2-1002 Gabions

Gabions consist of wire baskets filled with aggregate. They are covered in Article 7.04 of the *Standard Specifications*.

The wire baskets can be made of either galvanized steel or galvanized steel coated with polyvinyl chloride (PVC). The contractor must furnish a certified test report or materials certificate and certificate of compliance. The maximum dimension of the mesh opening must not exceed 4.5 in. (115 mm), and the area of the mesh opening must not exceed 8 sq. in. (9,500 mm²).

The baskets must be fabricated so that they can be assembled at the site. The front, back, base and lid must be woven at the factory in a single unit. All perimeter edges of the mesh must be securely selvaged. Lacing wire must be supplied in quantities sufficient to fasten all of the edges of the baskets and diaphragms and to provide for the internal connecting wires in each cell.

Each side of the aggregate for filling the baskets must be between 4 in. (100 mm) and 13 in. (330 mm) or 0.7 of the basket's smallest dimension, whichever is less. It should be reasonably well graded between the limiting sizes.

The baskets are assembled by binding together all vertical edges with lacing wire on 5 in. (125 mm) spacing, as shown in Figure 2-10.1, or by looping a single wire around the vertical edges, with a coil every 5 in. (125 mm). The empty baskets are set to line and grade. Adjacent baskets are laced together along the perimeter of their contact surfaces as shown in Figure 2-10.2. The empty baskets that form the upper tier of the construction are laced to the tops of the ones beneath them. A fence stretcher or other approved device must be used to remove any kinks and to hold the proper alignment of the units.

The aggregate must be placed carefully to assure alignment, avoid bulges, and produce a minimum of voids. The aggregate is placed up to the level of the first connecting wires. The sets of connecting wires are placed perpendicular to each other and tied around two meshes of each gabion wall. Figure 2-10.3 shows typical positions of the connecting wires. Then the aggregate is placed up to the level of the next connecting wires or to the top of the basket. The lid of the basket is stretched tightly over the aggregate until it meets the edges of the front and end panels. The lid is laced tightly along the edges, sides and diaphragms.

Figure 2-10.1 Gabion Field Assembly

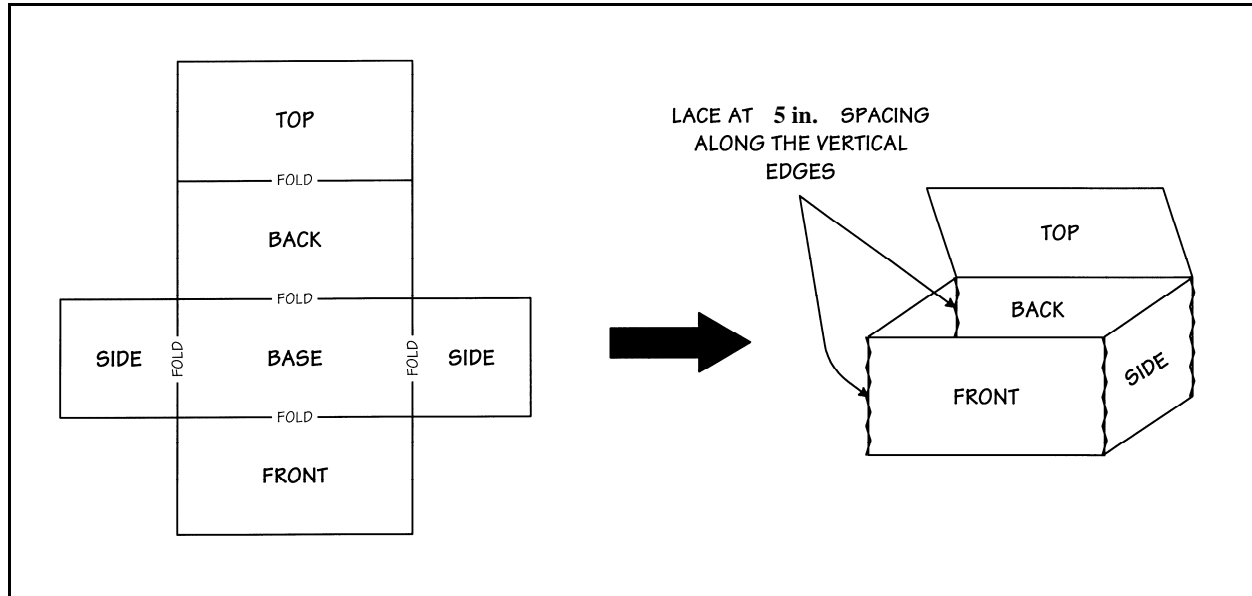
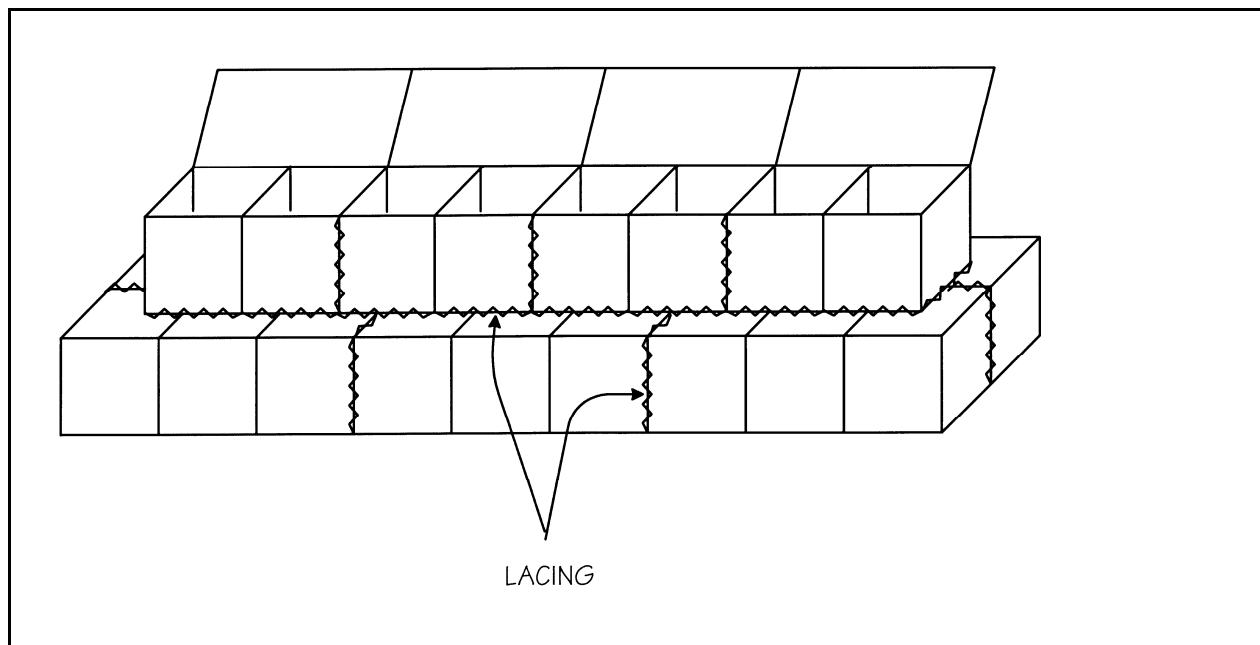


Figure 2-10.2 Gabion Placement

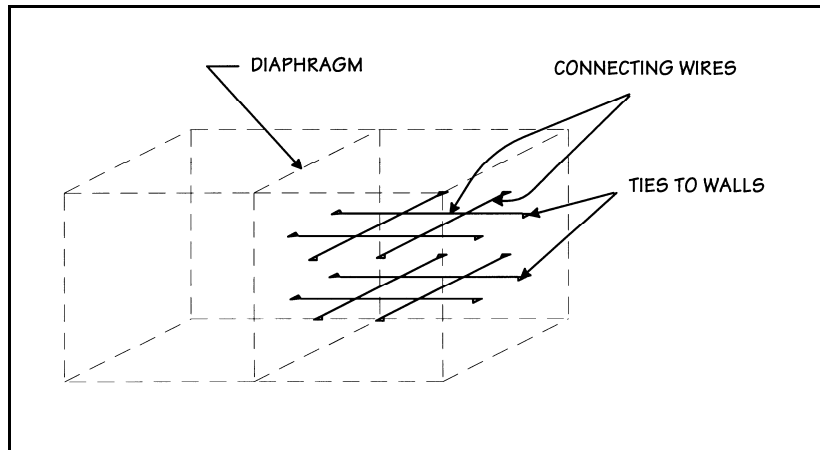


2-1003 Wire Fence

Wire fence consists of galvanized, chain link, or aluminum fence fabric supported by wood or metal posts. It is covered in Article 9.06 of the *Standard Specifications*. Fencing materials are covered in Article M.10.04.

2-1003A Wood Posts

For wire fence with wood line posts set in earth, the posts are set 10 ft. (3 m) apart and 3 ft. (1 m) in the ground and to the lines and grades given. For line posts set in rock, metal posts must be used.

Figure 2-10.3 Gabion Connecting Wires

The wire fabric normally is placed on the side facing the highway. The bottom of the fabric is placed 6 in. (150 mm) above the ground or as ordered by the Engineer. The fence is attached to the posts with galvanized staples 1½ in. (38 mm) long. A sufficient number of braces must be added to the posts to hold them firmly when the wire is stretched. Untreated posts are cut off 3 in. (75 mm) above the top wire on a bevel or as directed by the Engineer.

2-1003B Metal Posts

Line post spacing is the same as for the wood line posts above. Care must be taken to ensure the metal posts are plumb and the anchor plate is down. The posts should not be damaged when they are driven. When driving the posts, the tops must be protected by driving caps, or a suitable maul may be used.

When exposed ledge rock is encountered, the anchor plate is omitted from the metal post, and a hole is drilled into the rock at least 12 in. (300 mm) deep. The post is set in the hole using grout.

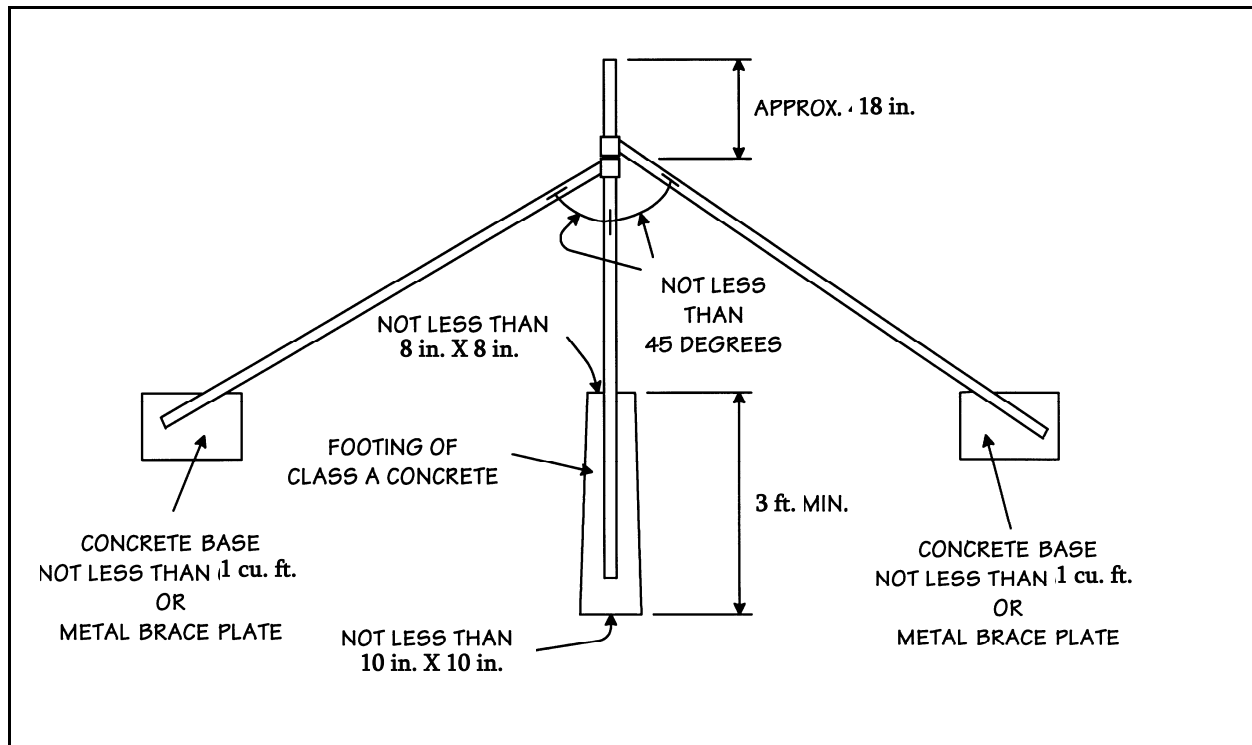
The Engineer directs on which side of the posts the wire fencing is placed. The fabric usually is placed 6 in. (150 mm) above the ground. It is attached to the posts using standard approved means, such as aluminum bands, zinc-coated steel bands, or spring-wire clips. Braced pull posts are installed as needed.

2-1003C End, Corner and Pull Posts

All end, corner and pull posts are set in concrete footings. The footings are constructed of Class A concrete, which may be hand mixed. The footings are a minimum of 3 ft. (1 m) deep and not less than 8 in. × 8 in. (200 mm × 200 mm) at the top and 10 in. × 10 in. (250 mm × 250 mm) at the bottom. Figure 2-10.4 shows a pull post.

Braces are attached about 18 in. (450 mm) from the top of the post. They must be long enough to be set in the ground and form an angle of not less than 45 degrees with the post. The braces can be set in concrete bases or attached to metal brace plates. The concrete base must be not less than 1 cu. ft. (0.03 m³). The brace plate must have a face area of not less than 1 sq. ft. (0.1 m²) and a thickness not less than 3/16 in. (5 mm).

Figure 2-10.-4 Wire Fence Pull Post



2-1004 Metal Beam Rail

Metal beam rail consists of a single or double line of rail elements fastened to galvanized steel posts, with or without rub rail. End treatments are as shown on the plans. The rail is erected at the locations and fabricated in accordance with the locations, designation, dimensions and details shown on the plans or ordered by the Engineer. Metal beam rail is covered in Article 9.10 of the *Standard Specifications*. Article 9.11 covers metal beam rail anchorages.

2-1004A Material Inspection

The posts, rail, rub rail, hardware, anchorage elements, etc., must be sampled at the project site in accordance with the "Schedule of Minimum Requirements for Sampling Materials for Test," published by the Materials Testing Division.

Before erecting the rail or anchorages, the Inspector should check galvanized elements. Any that have been cut or worked so as to destroy the galvanized coating and expose the base metal must be cleaned and painted with one coat of zinc dust-zinc oxide paint and a finish coat of aluminum paint.

2-1004B Posts

Posts are located in accordance with the plans, set plumb and in alignment with the rail or rail treatments. The contractor must provide extra-length posts at transitions or where field conditions warrant. The long posts must be long enough to maintain the minimum depth under the ground, as shown on the plans.

The steel posts are driven, except for the end-anchor posts. If rock or boulders are encountered, they are removed and the hole is backfilled and compacted before driving the posts. The contractor must provide suitable driving caps and equipment to prevent battering or injury to the posts and to prevent injuring the galvanized coating of the posts above ground line. End-anchor posts are set in dug holes. After the posts are set, the holes are backfilled and compacted. Surplus material must be removed.

The contractor should be cautious of buried cable for illumination or utilities located within the right-of-way. The cables may be “live.”

2-1004C Rail

If required, the brackets, rub rails, backup rails and rail elements must be erected to produce a smooth, continuous rail. If possible, the terminal sections, rub rails, and rail elements should be lapped in the direction of traffic.

If the rail installation is along a road with traffic, the contractor should complete the installation, including the end treatment, at the end of each day's work to avoid creating a hazard caused by leaving an exposed end of the beam or rub rail. If this is not practicable, the contractor must provide a temporary end treatment by lowering the rail to the ground and anchoring it by bolting, weighting, burying, etc. The contractor must submit to the Engineer a detailed plan for the temporary end treatment. No work is allowed until the plan is approved.

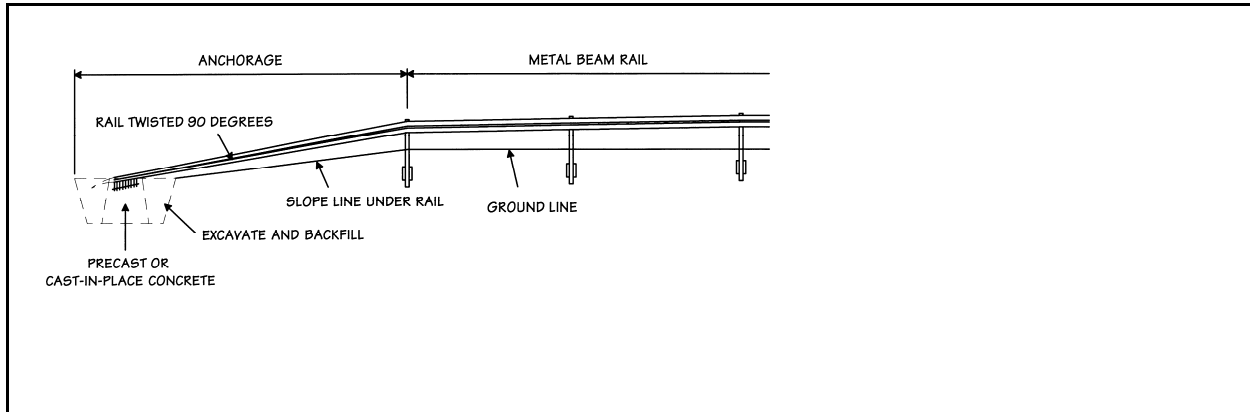
2-1004D Welding

In welding steel plates to steel posts, the welds will be the same size and shape as shown on the plans and must conform to the requirements of the current *Specifications for Welded Highway and Railway Bridges* of the American Welding Society, with two exceptions:

- Only a visual inspection of the welds is required.
- The Engineer will make the visual inspection. All welds must have no visual cracks or be defective in any way. All must be formed in a neat and workmanlike manner. Any welds found unacceptable will be corrected by the contractor at no additional cost.

2-1004E Anchorages

Figure 2-10.5 Metal Beam Guiderail Anchorage



The work involves the installation of concrete end anchors, fittings, rail elements, terminal sections, and posts. An example anchorage is shown in Figure 2-10.5. The excavation for the anchorage is backfilled with suitable material and compacted in 6 in. (150 mm) layers. Surplus material must be removed by the contractor.

If the rail is to be attached to rock, the rock is shaped as needed, and holes are drilled in the rock. The diameter of the holes is great enough to permit placing the bolts but must not exceed twice the diameter of the bolts. The bolts are installed in the holes, and the holes are filled with non-shrink grout. After the steel plate is installed, it and any spalled areas are filled with non-shrink grout. The same method is used for rail attached to concrete.

2-1005 Turf Establishment

The work consists of providing a uniform stand of established perennial turf grasses. It includes furnishing and placing fertilizer, seed and mulch as shown on the plans or ordered by the Engineer. Turf establishment is covered in Article 9.50 of the *Standard Specifications*. Materials for turf establishment are covered in Article M.13.

2-1005A Seedbed Preparation

Level areas, medians, interchanges and lawns are made friable and receptive to seeding by disking, tracking, or other methods approved by the Engineer. The final prepared and seeded soil must meet the lines and grades on the plans. Slopes and embankment areas are prepared by approved methods that do not disturb the line and grade of the slope surface. Seeding is never permitted on hard or crusted soil surfaces.

All areas to be seeded must be relatively free from weeds taller than 3 in. (75 mm). The weed growth can be mowed by hand or reduced with other approved methods that do not disturb the slope line or grade. Seeding on level areas is not permitted until essentially all of the weed growth is removed.

Slopes are to be seeded within 7 days after reaching final grade. Areas to be left more than 30 days without being worked are to be seeded or mulched as per Article 1.10.03-11 of the *Standard Specifications*.

2-1005B Seeding and Fertilizing

The calendar dates for seeding are:

- March 15 to June 15 for spring seeding and
- August 15 to October 15 for fall seeding.

Areas at final grade can be seeded within season. Other disturbed areas receive out-of-season seeding, although the contractor is still responsible for establishing the turf as described in “Establishment and Cleanup” below. During out-of-season periods, unseeded disturbed areas must receive water pollution control treatments, as in Article 2.10 of the *Specifications*. The treatments must be removed prior to seeding unless the Engineer allows them to remain.

Fertilizer initially is applied at 320 lb./A (360 kg/ha). When the permanent grass seeding growth reaches 6 in. (150 mm), the grass is mowed to 3 in. (75 mm), and another 320 lb./A (360 kg/ha) is applied. The second application must be hydraulically placed.

2-1005C Establishment and Cleanup

The contractor must maintain a uniform, established stand of the turf grass species. The height must be 6 in. (150 mm), and the stand must consist of no less than 100 plants/sq. ft. (1100 plants/m²). The contractor must maintain the established turf until the entire project is accepted.

The contractor must keep all equipment, vehicles and pedestrians off seeded areas to prevent excessive compaction and damage to young plants. If an area is compacted excessively, the contractor must rework the soil to form a seedbed, then reseed and mulch the area.

The contractor must keep all seeded areas free of weeds and debris. When the permanent grass growth reaches 6 in. (150 mm), the contractor must mow all slopes 4:1 or flatter to a height of 3 in. (75 mm). The mowing is done on a one-time-only basis. The contractor must clean up all debris from the turf establishment operation on the shoulders, pavement, and adjacent private or public property.

2-1006 Erosion Control Matting

Erosion control matting is installed following seeding, where called for on the plans or directed by the Engineer. Staples are placed according to the manufacturer's recommendations. Where two lengths of netting overlap, the end of the up-grade strip should overlap the down-grade strip. The contractor must maintain and protect the erosion control matting until the turf is established and must repair any damaged areas. No mowing is required where erosion control matting is installed.

2-1007 Sodding

Sodding consists of preparing a sodbed of 4 in. (100 mm) of tamped topsoil and furnishing and placing live sod. The work is covered under Article 9.53 of the *Standard Specifications*.

The work can be done at any time of year, but the sod cannot be frozen or placed on frozen earth. The contractor must notify the Engineer 48 hours before starting to work and cannot proceed until the Engineer grants permission. If seeding and sodding are to be done in the same general area, the sodding must be done prior to the seeding.

The contractor must take care to retain native soil on the roots of the sod during the process of transplanting it. Dumping the sod from trucks is not permitted. The sod should be placed within 24 hours after harvesting it unless it is tightly rolled roots to roots, kept moist, and protected from the sun and from freezing.

2-1007A Ground Preparation

There must be not less than 4 in. (100 mm) of tamped topsoil under the sod unless otherwise specified. Excavations or trenches must be made below the finished grade deep enough to accommodate the topsoil and sod.

If fertilizer was not applied to the topsoil during another operation, it is spread to provide 100 pounds of nitrogen per acre (110 kilograms of nitrogen per hectare). It must be incorporated in the topsoil to a depth of at least 2 in. (50 mm). It can be incorporated by disking, harrowing, drilling, raking, etc. Lime is not required but is permitted if applied in a previous operation.

2-1007B Planting

The soil on which the sod is laid must be reasonably moist and must be watered if needed. The sod is laid smoothly edge to edge. Any open areas are plugged with sod.

In drainage ways and areas requiring continuous or solid sodding, the sod is laid with its longest dimension parallel to the contours of the ground. The sod is placed first at the base of a slope, and work progresses up the slope parallel to the contour lines. Vertical joints are staggered from one course to the next.

After the sod is laid, it is immediately pressed into the sodbed by tamping, rolling, etc. to eliminate air pockets, provide smooth surfaces, ensure knitting, and protect exposed sod edges. It is watered at 5 gal./sq. yd. (20 L/m²).

2-1007C Pegging

Sod must be held in place with stakes in all drainage ways, on slopes steeper than 4:1, and where directed. Pegging is done immediately after tamping. At least one stake is driven through each sod, but not less than 2 ft. (600 mm) apart. The stakes are driven flush with their flat sides against the slope.

2-1007D Finishing and Maintenance

The contractor must dispose of extra soil and sod in an approved manner. Soil should not be ridged next to the sod. Excess or rejected sod will not be paid for.

The contractor must maintain the sodded area until all work on the contract is accepted. This may involve:

- protecting the sodded area with signs or barricades,
- mowing grass to a height of 2 in. (50 mm) when it reaches 4 in. (100 mm),
- watering the sod as directed by the Engineer, and
- repairing damaged areas of the sod.